

## RESTRICTION AND PREVENTION

OF

## DIPHTHERIA.

DOCUMENT ISSUED BY THE MICHIGAN STATE BOARD OF HEALTH.

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[106]

**Diphtheria is a Dangerous Contagious Disease**, hence the strict observance of the following precautions is of very great importance:

1. When a child or a young person has a sore throat, bad odor to its breath, especially if it has fever, it should immediately be kept separated from all other persons, except necessary attendants, until it be ascertained whether or not it has diphtheria or some other communicable disease.

2. **Every Person** known to be sick with diphtheria should be promptly and thoroughly isolated from the public; no more persons than are actually necessary should have charge of or visit the patient, and they should be restricted in their intercourse with other persons.

3. **Plain and distinct notices should be placed upon the premises** or house in which there is a person sick with diphtheria, and no person should be allowed to enter except physician, necessary attendants, and relatives who are to remain in isolation.

4. **Householders and physicians** must immediately give notice of the first case, and of every case of diphtheria, to the health officer. This is required by law, under penalty of fine, and imprisonment if fine is not paid.—§ 1675 and § 1676 Howell's statutes.\*

SEC. 50 (Which is § 1681a Howell's supplement) provides for compensation to physicians for reporting.

5. **Croup.** Modern researches point to a probable common origin of diphtheria and membranous or inflammatory croup; therefore, membranous or inflammatory croup should be recognized as a communicable disease dangerous to the public health, and should be reported, and isolation and disinfection should be enforced the same as in other cases of diphtheria.

6. **In all cases of sore throat**, precautions should be taken. It is often difficult to distinguish mild cases of diphtheria from a simple tonsillitis, pharyngitis, or laryngitis, and such mild cases of diphtheria often communicate a dangerous and fatal form of diphtheria; therefore, it is the duty of physicians and householders in reporting diseases dangerous to the public health, and of local health authorities in their efforts to restrict such diseases, in every case, to give to the public safety the benefit of the doubt, and in localities where diphtheria exists to regard cases of acute sore throat as suspected cases of diphtheria.

7. **Bacteriological Tests.** No health officer should fail to act for the restriction of diphtheria in any case of sore throat in which there is doubt, certainly not until bacteriological tests have proved the absence of the Löffler bacillus (now known to be the specific cause of true diphtheria), and of the streptococci; streptococcus diphtheria also being a dangerous disease. Such tests will be made at cost by the "State Laboratory of Hygiene, Ann Arbor, Michigan;" to which application should be made before sending material, unless it is sent in the specially-prepared sterilized culture tubes. Disease germs cannot lawfully be sent by mail, therefore must go by express or special messenger.

8. **Duties of local board of health.** Upon receipt of notice of diphtheria, the board of health has duties to perform, in taking measures to

\* Supervisors must prosecute for all such forfeitures; township officers must give notice to supervisors; prosecuting attorney to conduct suit if requested; see sections 8439, 8440 and 8442, Howell's statutes. Health officers of villages and cities must notify prosecuting attorney of all violations of these two sections. See § 1684, Howell's statutes; the prosecuting attorney must prosecute for all such forfeitures incurred within his county. See § 8442, Howell's statutes.



restrict the spread of the disease, which it is a great violation of public trust for it to neglect or postpone. That no time may be lost, it is the duty of every board of health to make provision for prompt action by its health officer, authorizing and directing him to be prepared at all times, as executive officer of the board, to take certain action without waiting for a meeting of the board, whenever a case of diphtheria occurs within its jurisdiction. The duties of the local board of health relative to the restriction and prevention of diseases, are treated in circular No. 120 issued by this Board.

**Some of the duties of the health officer, required by law, may be briefly suggested as follows:** He should, whenever he has reason to believe that there is in his jurisdiction a case of diphtheria—

- a. Promptly investigate the subject.†
- b. Order prompt and thorough isolation of those sick or infected with diphtheria.
- c. See that no person suffers for lack of nurses or supplies.
- d. Give public notice of infected places by placard on the premises, and otherwise if necessary.
- e. Notify teachers or superintendents of schools concerning families in which there are cases of diphtheria.
- f. Supervise funerals of persons dead from diphtheria.
- g. Disinfect rooms, clothing and premises, and all articles likely to be infected, before allowing them to be used by other persons than those in isolation.

h. Keep the president of his board of health and the secretary of the State Board of Health constantly informed respecting each outbreak of diphtheria.

These duties are required by Act 137, laws of 1883, unless modified by official action of the local board of health. Section 2 of this act, as amended by Act No. 34, approved March 28, 1889, provides that—

*"Whoever shall knowingly violate the provisions of section one of this act, or the orders of the health officer made in accordance therewith, shall be deemed guilty of a misdemeanor, and upon conviction thereof he shall be punished by a fine not exceeding one hundred dollars, and the costs of prosecution, or in default of payment thereof, by imprisonment not exceeding ninety days in the county jail, in the discretion of the court."*

In the absence of regulations made by the local board of health conflicting therewith, orders by the health officer in the lawful performance of these duties have the force of regulations by the board of health.

The penalty applies to the health officer, as well as to whoever violates his orders. The health officer should also give certificates of recovery and of freedom from liability to give diphtheria; but not until after thorough disinfection following complete recovery.‡

Two sections of the law relating to duties of boards of health are:

(1732) SEC. 41. When the small-pox or any other disease dangerous to the public Notice of In-health, is found to exist in any township, the Board of Health shall use all possible care fected places. to prevent the spreading of the infection; and to give public notice of infected places to travelers, by such means as in their judgment shall be most effectual for the common safety.—§ 1673 Howell's Annotated Statutes.)

(1707) SEC. 16. If any such infected person cannot be removed without danger to Provision in his health, the Board of Health shall make provision for him as directed in the pre- case infected ceding section, in the house in which he may be, and in such case they may cause persons cannot the persons in the neighborhood to be removed, and may take such other measures be removed. as they may deem necessary for the safety of the inhabitants.—(§ 1648 Howell's Annotated Statutes.)

Under § 1647, Howell's statutes the local board of health is required to provide "nurses and other assistance and necessities," which includes medical attendance when required, for the maintenance of every person isolated or restrained from the public on account of diphtheria.

† He should act without question for the restriction of any case reported to him as diphtheria by any reputable physician. See also paragraphs numbered 5, 6 and 7, on page one.

‡ Such certificates should not be given less than three weeks after apparent recovery, except bacteriological examination proves the throat to be free from the specific cause, for reasons stated in the last paragraph on page 3. See paragraph numbered 7, on page 1.



9. **Children believed to be uninfected** may be sent away from the house in which there is diphtheria to a family in which there is no young person especially liable to the disease, or to a previously disinfected convalescent ward in a hospital; but in either case they should be isolated from the public until the expiration of the period of incubation, counting from the time of their removal.

10. **The administration of antitoxic serum**, by physicians, has been found to be safe and quite effective as a preventive measure, especially in children; and when circumstances are such that they must remain in the same house with a person sick with diphtheria, the antitoxin is so very important that it cannot properly be neglected. But where the antitoxin is administered, as well as under all other circumstances, the isolation and final disinfection of those infected and their surroundings should not by any means be neglected.

11. **The room in which one sick with diphtheria is to be placed** should previously be cleared of all needless clothing, carpets, drapery, and other materials likely to harbor the poison of the disease. This room should constantly receive a liberal supply of fresh air, without currents or drafts directly upon the patient. It will be well also to have the sun shine directly into the room.

**The room which has been occupied by a person sick with diphtheria** should, as soon as vacated, with all its contents, be promptly disinfected.

12. **The discharges from the throat, nose and mouth** are extremely liable to communicate the disease, and should be received in vessels containing a strong disinfectant, or on soft rags or pieces of cloth, which should immediately be burned.

13. **The discharges from the kidneys and bowels** may be passed into vessels containing a strong disinfectant, and then be *buried* at least 100 feet distant from any well; each discharge may be disinfected by thoroughly mixing with it not less than one ounce of chlorinated lime; when this is impracticable it should be passed on old cloths, which should immediately be burned.

14. **The clothing, towels, bed-linen, etc.**, on removal from the patient should at once, before removal from the room, be placed in a pail or tub of zinc-solution, made in proportion as follows: Water, one gallon; sulphate of zinc, four ounces; common salt, two ounces.

15. **Nurses and attendants** should be required to keep themselves and their patient as clean as possible; their own hands should frequently be washed and disinfected by chlorinated soda, or other disinfectant.

16. **All persons recovering, or very recently recovered, from diphtheria** should be considered dangerous; therefore such a person should not be permitted to associate with others, or to attend school, church, or any public assembly until the throat and any sores which may have been on the lips or nose are healed, nor until, in the judgment of a careful and intelligent health officer, he can do so without endangering others. The bacillus which is the specific cause of diphtheria, has been found in the throat weeks after apparent complete recovery from the disease. **The duration of infectiousness is now proved to be at least three weeks**, so that three weeks should be the shortest period of isolation after apparent complete recovery. No convalescent from diphtheria should be permitted to associate with the people until after all his clothing that has been exposed to infection has been thoroughly disinfected, and this without regard to the time which has elapsed since recovery, if the time is less than one year. No person from premises in which there is or has been a case of diphtheria should attend any school, Sunday-school, church, or



public assembly, or be permitted by the health authorities or by the school board to do so, until after disinfection of such premises and of the clothing worn by such person, if it has been exposed to the contagion of the disease. Every person exposed to diphtheria by remaining in the room with a person sick with the disease, should remain isolated, or at least be under the close surveillance of the health officer until after the expiration of the period of incubation of the disease.

**17. The face and hands of a person who has died of diphtheria** should be washed with a zinc solution of double the strength stated in paragraph 9, the body then wrapped in a sheet wet with the zinc solution, and at once buried. In no case should the body be exposed to view. No undertaker's stand with draperies to be used at any other funeral, should be used.

**18. No public funeral** should be held at a house in which there is a case of diphtheria, nor in which a death from diphtheria has recently occurred. Except under extraordinary precautions there should be no public funeral of a person who has died from diphtheria. No child should attend, and it would be better in most cases that few adults should attend a funeral of a person dead of diphtheria. Any public notice of the death should state the cause as diphtheria, to prevent attendance at the funeral, or visits to the residence.

#### DISINFECTION OF ROOMS, CLOTHING, ETC.

**19. After a death or recovery from diphtheria**, the room in which there has been a case of diphtheria, whether fatal or not, should, with all its contents, be thoroughly disinfected by exposure for several hours to strong fumes of burning sulphur, and then, if possible, it should, for several hours or days, be exposed to currents of fresh air.

*a.* Because of the innumerable ways in which the contagion may be scattered about the house and premises where there has been a case of diphtheria, the entire house and out-buildings, including cellar, garret, woodshed, and privy, will usually need to be disinfected.

*b.* Rooms to be disinfected must be vacated. Heavy clothing, blankets, bedding, and other articles which cannot be treated with the zinc solution, should be spread out so as to be thoroughly exposed during fumigation, which should take place in the room where the clothing, etc., have been used in connection with the patient. For a room ten feet square, at least three pounds of sulphur or eight ounces of a forty per cent solution of formaldehyde should be used; for larger rooms, proportionately increased quantities, at the rate of three pounds of sulphur, or eight ounces of a forty per cent solution of formaldehyde, for each 1,000 cubic feet of air space.

Room disinfection by formaldehyde is fully explained in "Teachers' Sanitary Bulletin" No. 9, December, 1898, issued by this State Board of Health.

*c.* Close all openings to the room, place the sulphur in an iron pan supported upon bricks, set it on fire by hot coals or with the aid of a spoonful of alcohol lighted by a match, be careful not to breathe the fumes of the burning sulphur, and when certain the sulphur is burning well, leave the room, close the door, and allow the room to be closed for several hours.

*d.* Care should be taken to secure the complete burning of as much of the sulphur as is possible. For this purpose the iron pan or pot in which the sulphur is to be placed may previously be heated, or placed in the room over hot coals in a pan of ashes set upon bricks. To avoid danger of



fire the iron pot or pan in which the sulphur is burned should be free from any leak, and it may be placed over water in a tub or pan.

Because of the law of diffusion of gases, and the numerous crevices through which sulphur fumes may pass, sufficiently strong fumes do not remain in a room long enough, unless the combustion of sulphur is somewhat rapid and continues a considerable time. The best results are obtained by using roll brimstone broken up, or flowers of sulphur, burning the sulphur in shallow pans of sufficient number and size to rapidly fill the room with the fumes, and having quantities sufficient to last for several hours. Our experience, of the health officers in Michigan, seems to have demonstrated that, whatever may be true in the laboratory, in the ordinary homes of the people, in the manner above mentioned, and *without the presence of the vapor of water*, the diphtheria bacillus is rendered incapable of causing diphtheria. This is a very important fact, because it enables us to successfully disinfect rooms without the destruction of much property which would be entirely ruined if the vapor of water were present. The experience in Michigan during ten years is shown in the diagram on page 8.

*e. Body and bed clothing, etc.*—It is best to burn articles which have been soiled by discharges from the throat, nose or mouth of a person sick with diphtheria. Articles to be burned should be thoroughly and quickly burned, so as not to diffuse the poison. In the glowing furnace under a large boiler is a good place. If the burning is done in the open air it should be far from dwellings and by a quick, strong fire. Articles too valuable to be destroyed should be exposed for one hour to superheated steam under pressure, or for one hour to a dry heat of from 240° F. to 250° F. or to be treated as follows:

*f. Cotton, linen, flannels, blankets, etc.*, should be treated with the boiling-hot zinc-solution, introducing them piece by piece, securing thorough wetting and boiling for at least half an hour. Heavy woolen clothing, silks, furs, stuffed bed covers, beds and other articles which cannot be treated with the zinc solution, should be hung in the room during fumigation, pockets being turned inside out, and the whole garment being thoroughly exposed. Afterwards they should be hung in the open air, beaten and shaken. Carpets are best fumigated on the floor, but should afterwards be removed to the open air and thoroughly beaten. Pillows, beds, stuffed mattresses, upholstered furniture, etc., after being disinfected on the outside, may be cut open and their contents again exposed to fumes of burning sulphur. In no case should the thorough disinfection of clothing, bedding, etc., be omitted. Infected clothing and bedding have been known to communicate diphtheria months after their infection.

#### TEMPORARY SHELTER DURING DISINFECTION.

20. Disinfection of a room always necessitates vacating it, and sometimes makes it impossible to remain in adjoining rooms; therefore in some cases it seems essential to have hospital, tent or other temporary shelter for the inmates of infected houses, where bathing, disinfection and washing can be done while such houses are being disinfected and put in order. On this subject local boards of health should be consulted, and should be prepared to act.

21. **Hospitals for persons sick with diphtheria.**—As a means of preventing the spread of disease, the law (§§ 1667–1671 and §§ 1647–1648, Howell's Statutes) authorizes the inhabitants of townships, cities and villages to be constantly provided with hospitals for the reception of per-



sons having small-pox, or any other disease dangerous to the public health, and requires local boards of health on the outbreak of any such disease to provide such hospitals or places of reception for the sick and infected as they shall judge best for their accommodation and the safety of the inhabitants, and to cause such sick or infected persons, if their condition will admit, to be removed to such hospitals or places of reception—said hospitals, and ( in case the sick cannot be removed to the hospital without danger to life or health ) the houses where the sick may remain, and all persons connected with said hospitals or abodes of the sick to be subject to the regulations of the board of health, or of a committee appointed by the board of health for that purpose.

Penalty for violating regulations of hospitals.

(1733.) SEC. 42. If any physician or other person in any of the hospitals or places of reception before mentioned, or who shall attend, approach, or be concerned with the same, shall violate any of the regulations lawfully made in relation thereto, either with respect to himself, or his or any other person's property, the person so offending shall for each offense, forfeit a sum not less than ten nor more than one hundred dollars.—§ 1674 *Howell's Statutes*.

#### HOW TO AVOID AND PREVENT DIPHThERIA.

**22. Avoid the special contagium of the disease.** This is especially important to be observed by children and all whose throats are sore from any cause. Children under ten years of age are in much greater danger of death from diphtheria than are adults; but adult persons often get and spread the disease, and sometimes die from it. Mild cases in adults may cause fatal cases among children. Because of these facts it is frequently dangerous for children to go where adult persons go with almost perfect safety to themselves.

**23. Do not let a child go near a case of diphtheria.** Do not permit any person or thing, or a dog, cat, or other animal to come from a case of diphtheria to a child. No cat or dog should be permitted to enter the sick room. Unless your services are needed, keep away from the disease yourself. If you do visit a case, bathe yourself and change and disinfect your clothing before you go where there is a child.

**24. The contagium of diphtheria sometimes retains its virulence for a long time, and may be carried a long distance in articles in which it has found lodgment.** Do not permit a child to enter a privy or water-closet, or to breathe the air from a privy, water-closet, cess-pool or sewer into which undisinfected discharges from persons sick with diphtheria have entered, nor to drink water or milk which has been exposed to such air.

**25. Do not permit a child to ride in a hack or other closed carriage in which has been a person sick with diphtheria, except the carriage has since been thoroughly disinfected with fumes of burning sulphur, as specified in paragraphs 19 and 20.**

**26. Abrasions of the skin or mucous membrane favor the contraction of diphtheria.** The disease spreads most at such seasons of the year as sore throats prevail. All influences which cause sore throats probably tend to promote the taking and spreading of this disease. Avoid exposure to wind and to breathing cold, dry air.

**27. Do not wear or handle clothing worn by a person during sickness or convalescence from diphtheria.**

**28. Beware of any person who has a sore throat.** Do not kiss such a person. Do not drink from the same cup, blow the same whistle, or put his pencil or pen in your mouth.

**29. Beware of crowded assemblies in unventilated rooms.**

**30. Individual drinking cups should be used.** A common drinking cup should not be used, especially in school rooms and places where there is liability of infection. Diphtheria bacilli have been found on cups



in actual common use in schools. A fountain cup would be less liable to spread disease, because the water continually overflows the sides and tends to wash away any infection which might otherwise collect on the edges of the cup

**31. Diphtheria not derived from filth, unless the germ is there.** Until recent years the supposition has prevailed that cases of diphtheria might arise *de novo* from a filthy condition of premises, backyards, privy-vaults, cess-pools, etc.; but later researches have made it plain that this notion is not a correct one. Filthy conditions may serve to harbor the germs, but they do not produce the germ. According to Loeffler, the bacilli (rod-shaped microscopic plants) which cause diphtheria, grow outside the body at a temperature of 20 C. (68° F.). According to the extensive sickness statistics collected by the Michigan State Board of Health, diphtheria is at its minimum in July, and nearly so in June and August. Inasmuch as these three are the only months in the year in which the atmospheric temperature approaches that at which the diphtheria bacillus is reproduced, it seems to be proved that, in Michigan, the greatest amount of the diphtheria cannot come from bacilli *reproduced* outside a living body, but must be caused by germs reproduced within a body. Statistics, shown in the diagram on page 8, prove that in those outbreaks in which isolation of patients and disinfection of things infected by patients are enforced, there are only about one-fifth as many cases as in those outbreaks in which isolation and disinfection are not enforced. This seems to prove that at least four-fifths of the cases of diphtheria in Michigan come almost directly from a preceding case. The practical conclusion is that the cause of diphtheria in Michigan need not usually be looked for outside the human body or its excretions. The disease is propagated in the body, and spread *from person to person*, directly and indirectly.

The *bacillus* which causes diphtheria does not generally enter the blood. The *poison* generated by the bacillus, is absorbed into the body, and causes degenerations of muscular tissue, heart failure, paralysis, etc.; but the germ generally remains in its locality, usually in the throat. Therefore the spread of this disease is mainly from the throat and mouth. Everything touched by the mouth, or by the discharges from the mouth, throat or nose, may be infected.

**Disinfection is necessary.** Diphtheria bacilli in a comparatively dry state remain capable of renewed activity for at least four or five months. Therefore dust derived from the discharges from the throat, mouth, or nose, may cause the disease months, and possibly years, after the bacilli have left the throat in which they were propagated. This is the reason why disinfection is necessary.

**32. Penalty for spreading diphtheria.** The law (Act 15, laws of 1891) now provides a penalty of "a fine of not less than twenty-five dollars, nor more than one hundred dollars, or by imprisonment in the county jail not less than twenty days, nor more than ninety days," for any person who shall knowingly or wilfully subject, or be instrumental in subjecting, another person to the danger of contracting small-pox, diphtheria or scarlet fever.

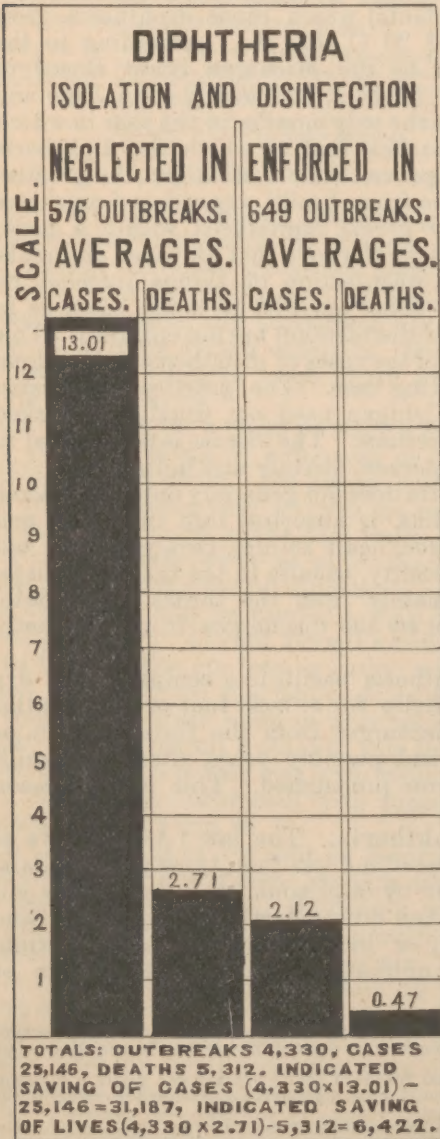
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The State Board of Health recommends that local boards of health procure and distribute copies of this document within their jurisdictions, especially when diphtheria is near, and certainly to the neighbors of families in which diphtheria is present.

In order that this document may do the greatest possible good, it is hoped that each one who receives it will not only make such use of it as will tend to disseminate most widely the suggestions and statements of fact contained therein, but will also *act for the restriction or prevention of this disease* in accordance with its suggestions, or by other effective measures.



# ISOLATION AND DISINFECTION RESTRICTED DIPHThERIA IN MICHIGAN DURING THE 10 YEARS 1887-'96.



[PLATE 1892]

DIPHThERIA IS PROVED TO BE A COMMUNICABLE DISEASE, WHICH IS RESTRICTED BY ISOLATION OF INFECTED PERSONS AND THINGS, AND THEIR COMPLETE DISINFECTION.

33. The accompanying diagram, plate 1003, accurately represents the degree of success of efforts for the restriction of diphtheria in Michigan during the ten years ending with 1896. It also demonstrates the truth of the heading over this paragraph. In compiling the table on which the diagram is based, all reports were used which definitely stated the facts concerning an outbreak the beginning and ending of which could be determined. In Detroit, and a few other cities, diphtheria was present all of the time, therefore no exact beginning or ending of an "outbreak" could be fixed upon. The statistics therefore relate to townships, villages and small cities.

During the ten years, 4,330 outbreaks, in which occurred 25,146 cases and 5,312 deaths, were reported to the State Board of Health. Of 4,330 outbreaks, the facts, as to what was done, were reported definitely in 1,225 outbreaks. In 576 outbreaks restrictive measures were *neglected*; and in 649 outbreaks restrictive measures were *enforced*. In those outbreaks in which restrictive measures were *neglected*, there occurred an average of 13.01 cases and 2.71 deaths. In those outbreaks where restrictive measures were *enforced*, there occurred only 2.12 cases, and .47 of one death,—about one-sixth as many cases and about one-sixth as many deaths as in those outbreaks where restrictive measures were neglected. It seems fair to assume that had restrictive measures been neglected in all the outbreaks there would have occurred  $(4,330 \times 13.01)$  56,333 cases and  $(4,330 \times 2.71)$  11,734 deaths. Subtracting the number of cases (25,146) and the number of deaths (5,312) that actually did occur from the number of cases which would probably have occurred had restrictive measures been wholly neglected, there remain 31,187 cases and 6,422 deaths which, apparently, were prevented by the enforcement of restrictive measures in some of the outbreaks.

The statistics in this diagram prove that after one case of diphtheria has occurred in a township, village or small city, the disease has been, by isolation and disinfection, so restricted that, on the average, only 2.12 cases and .47 of one death occurred. (This was without the aid of antitoxin.) If the same measures which were enforced in the 649 outbreaks were enforced in every outbreak, diphtheria should soon become a rare disease.